CLAIMS

What is claimed is:

1. A plasma processing apparatus for processing a substrate, comprising:

a plasma processing chamber with chamber walls;

a substrate support within the chamber walls;

at least one confinement ring, wherein the confinement ring and the substrate support define a plasma volume;

a magnetic source for generating a magnetic field for magnetically enhancing physical confinement provided by the at least one confinement ring.

2. The plasma processing apparatus, as recited in claim 1, wherein the magnetic source comprises a first magnetic element placed on a first side of the at least one confinement ring and a second magnetic element placed on a second side of the at least one confinement ring.

3. The plasma processing apparatus, as recited in claim 2, wherein the magnetic field increases collisions of charged particles with the at least one confinement ring.

4. The plasma processing apparatus, as recited in claim 3, wherein the magnetic fields pass through the confinement rings.

5. The plasma processing apparatus, as recited in claim 3, wherein the first magnetic element forms a ring shape with a diameter and the second magnetic element forms a ring shape with a diameter, and wherein the confinement rings have an inner diameter and an outer diameter, wherein the diameters of the first magnetic element and the second magnetic element are less than the outer diameter of the confinement rings and greater than the inner diameter of the confinement rings.

6. The plasma processing apparatus, as recited in claim 5, wherein the diameter of the first magnetic element is not equal to the diameter of the second magnetic element.

7. The plasma processing apparatus, as recited in claim 2, wherein the magnetic fields pass through the region of the confinement rings.

8. The plasma processing apparatus, as recited in claim 7, wherein the first magnetic element forms a ring shape with a diameter and the second magnetic element forms a ring shape with a diameter, and wherein the confinement rings have an inner diameter and an outer diameter, wherein the diameters of the first magnetic element and the second magnetic element are less than the inner diameter of the confinement rings.

9. The plasma processing apparatus, as recited in claim 2, wherein the confinement ring is movable to define a variable gap, wherein the variable gap is used to vary pressure in the plasma volume.

10. The plasma processing apparatus, as recited in claim 9, wherein the first magnetic element and second magnetic element do not cross the variable gap.

11. A method for processing a substrate, comprising:

placing the substrate in a process chamber;

providing a gas from a gas source to the process chamber;

generating a plasma from the gas in the process chamber;

flowing the gas through a gap adjacent to at least one confinement ring to provide physical confinement of the plasma; and

providing magnetic confinement of the plasma to enhance the physical confinement of the plasma.

12. The method, as recited in claim 11, wherein the providing the magnetic confinement, comprises providing a magnetic field in the region of the confinement rings.

13. The method, as recited in claim 12, wherein the magnetic field increases collisions of charged particles with the confinement rings.

14. The method, as recited in claim 12, wherein the magnetic field passes through the at least one confinement ring.

15. The method, as recited in claim 14, further comprising moving the at least one confinement ring to control plasma pressure.

16. The method, as recited in claim 15, wherein the magnetic confinement provides a radially symmetric magnetic field.

17. A semiconductor device made by the method, as recited in claim 11.